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Cost of Production and Profitability Analysis on Mango Orchards in Krishnagiri District of Tamil Nadu

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ABSTRACT

The "king of fruits" in the most commercially and economically supporting for the peasant farming of our country. India is the top most producer in the world and significant contribution is provided by Tamil Nadu. Hence the study was carried out in Krishnagiri District of Tamil Nadu with a sample size of 80 with the objective of cost of production and profitability of mango orchard. The study found that the average establishment cost of the orchards is Rs. 290937.5 per ha and the cost of cultivation/ha is Rs. 93674.16 per ha. The average yield of the sample respondent was 23.08 tonnes and generates a net income of Rs. 229492.5. It was also found that the BCR at 15% discount rate was 1.98 showed the feasibility of mango orchard cultivation.

***Key words*:** Cost and returns, Mango, Benefit cost ratio, Cost of production

Mango (*Mangifera indica* L.) belonging to the Anacardiaceae family, is the most important fruit of India. It is known as "King of fruits" and is the most important commercially grown fruit crop of India. These crops spread over 90 countries in different climate conditions across the world. It has been in cultivation in the Indian sub-continent for well over 4000 years and has been the most favorite fruit since ages. South & South-east Asian countries, African countries, tropical Australia and the USA, Venezuela, Mexico, Brazil, Australia, West Indies Islands and Cambodia. Mango covers an area of 5565 thousand ha [1] where India occupies top position among the mango growing countries of the world and produces 45.1 per cent of the total world mango production. China and Kenya stand second and third among mango producing countries with a share of 9.0 per cent and 5.7 per cent respectively.

The major mango producing states in term of area and production is depicted in (Fig 1-2). It represents that area wise Andhra Pradesh stood first with 14.71 per cent of the national mango area, followed that, Uttar Pradesh 11.70 per cent, Telengana7.98 per cent, Karnataka 8.51 per cent and Tamil Nadu 7.11 per cent [2]. Production wise Uttar Pradesh stood first place with 23.06 per cent of Indian mango production, next to that Andhra Pradesh 16.06 per cent, Telengana 8.54 per cent, Karnataka 9.29 per cent, Gujarat 6.76 per cent and Tamil Nadu at5.87 per cent. There are 1000 varieties of mango in India but only about 30 varieties are grown commercially.

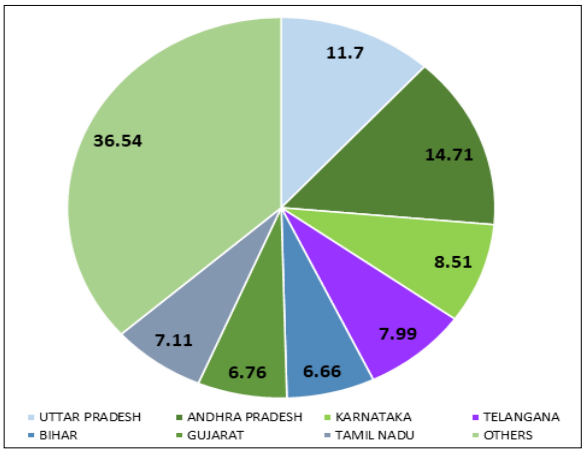

Fig 1 State wise mango cultivation in India 2017-18

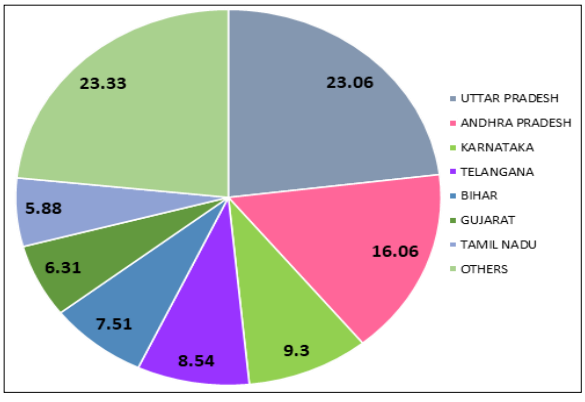

Fig 2 State wise mango production in India 2017-18

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The prominent varieties are Alphonso, Banganpalli, Chausa, Dashehri, Langra, Totapuri, and Kesar. India is also a well-known exporter of fresh mangoes and mango pulps. The country has exported 46,601.83 Metric Tonnes of fresh mangoes to the world for the worth of Rs. 356.66 crores during the year 2017-18. India exports mango to over 40 countries worldwide. The verities such as Alphonso, Dashehri, Kesar and Banganapalli have the higher demand in the International market and India exports to over 40 countries, the major importer are United Arab Emirates, United Kingdom, Saudi Arabia and Qatar are the major importer of Indian mango [3].

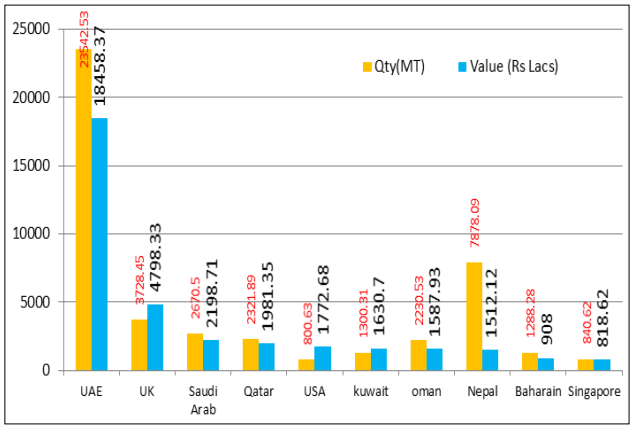

Fig 3 Fresh mango export in India 2017-18

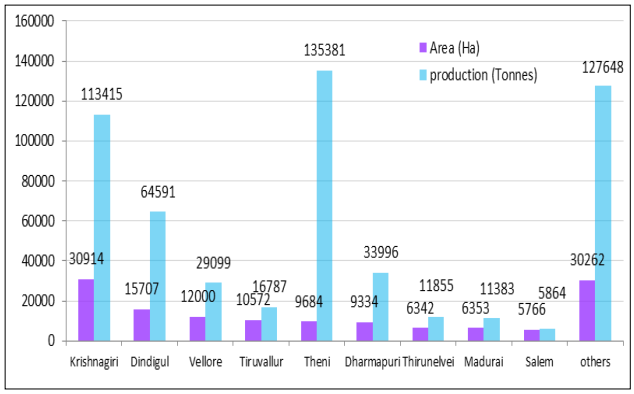

Fig 4 District-wise mango cultivation and production in Tamil Nadu-2017-18

Tamil Nadu accounted for six per cent share in total Indian mango production. The major mango growing districts in Tamil Nadu are Krishnagiri, Dharmapuri, Vellore and Theni etc. Krishnagiri stands first in production with the share of 22 per cent followed by Vellore and Theni with nine per cent and six per cent respectively. The average productivity of mango in Krishnagiri district was five tonnes per hectare. Major varieties cultivated are Mulgova, Thothapuri, Senthura, Manoranjitham, Neelam, Kalappad, Banganapalli, Alphonso, Chakkarakutty, Rumani, Imampasanth and Mallika. Among these varieties, the area under Neelam, Thothapuri and Chenthura alone accounted for 93.18 per cent to the total area under mango plantation [4]. The man objectives of the study are:

i. To analyze cost and returns and economic feasibility of mango orchard in Krishnagiri district.
ii. To analyze the problems in production and marketing of mango in the study area.

MATERIALS AND METHODS

The study was carried out in Krishnagiri district of Tamil Nadu. It employed multistage sampling method to select the district at first stage, since it accounted maximum share in state's mango area, in next stage, blocks were arranged in descending order based on mango area and first four blocks were selected namely Bargur, Kaveripatinam, Mathur and Shoolagiri. The total sample size of the study was fixed at 80 and evenly distributed among the four selected blocks. In the last stage sample respondents were randomly selected from the farmers list. Well-structured and pre tested interview schedule was used to collect the data pertained to cost and returns in mango production and problems encountered by the farmers.

Amortized cost

The annual amortized cost work out from investment made from mango orchard and assuming the rate of interest 8 per cent per annum and the expected life of mango orchard to be 50 years.

$$I = B \frac{i}{1-(1+i)n}$$

I = Annual cost (in Rs),
B= Present fixed cost (in Rs)
i= interest per annum 8%
n= Economic life of orchard (in years)

Cost of cultivation of mango cultivation

Mango being a perennial crop cost estimation and cost of production prescribed recommended by CACP were used in their study. There are three components in costs of cultivation estimation of (i.e.) Establishment cost, Maintenance cost and Returns.

Establishment cost

Expenditure on land preparation, cutting/ seedlings, fertilizers, setting up of irrigation system (Drip irrigation/Sprinkler system) are considered in estimating the establishment cost which one time, in the first year.

Maintenance cost

The annual maintenance cost generally includes expenditure on plant protection chemicals, farmyard manure, irrigation, fertilization, weeding, operation cost on inter crops if any are to be considered and the costs are recorded in every year.

Cost concepts for horticultural crops

Cost concept used by Commission by Agricultural Cost and Prices (CACP)
Cost A_1: It consist of all actual expanse in case and if includes cost of cuttings, labour wages, plant production chemicals, fertilizers, farm yard manure, land preparation, depreciation on greenhouse protected cultivation technology of fixed capital.
Cost A_2: Cost A_1 plus rent paid for leased – in land
Cost B_1: Cost A_1 plus interest on owned fixed capital (excluding land)
Cost B_2: Cost B_1 plus imputed rental value of owned land plus rent paid for leased us
Cost C_1: Cost B_1 plus imputed value of family labour
Cost C_2: Cost B_2 plus imputed value of family labour

Cost C_3: Cost C_2 Cost C_2 plus 10 per cent of cost C_2 as management cost

Returns

Gross income

Gross income was obtained by arriving at the total value of mango harvest per acre values at harvest price in the reference period.

Net income

The net income was computed by subtracting to the total (cost c) from the gross income.

Cost of production per unit

Cost of production per kilogram of mango was arrived at by dividing the total cost of cultivation per acre by the total per yield of mango percentage in kilograms.

Output / input ratio

Output – Input ratio was obtained by dividing the gross income by the total cost of production per hectare.

Investment analysis

The worthiness of investments on perennial crops in which cost and benefits are distributed over years has to be evaluated by taking into consideration of the expected life year. In the present study, the productivity of capital was measured using discounted measures such as net present value, benefit- cost ratio and internal rate of return.

Economic viability of mango plantations

Capital budgeting techniques like Net Present Value (NPV), Benefit Cost Ratio (BCR), and Internal Rate of Return (IRR) were employed to assess the economic viability of mango orchard.

Net present value (NPV)

Net present value is helpful in working out benefit cost ratio of the project. The selection criterion of the project depends upon the positive value of the net present worth, when discounted at the opportunity cost of the capital. Net present value is an absolute measure, but not relative, NPV of the project is estimated using the following equations.

$$NPV = \sum_{t=1}^{T} \frac{B_t - C_t}{(1+r)^t} - C_o$$

Where;

B_t-C_t = Net returns, in rupees, in period t

R = Rate of discount at

t = Time period t = 0,1,2…T,

C_o = Investment cost at t = 0., establishment and maintenance cost

Benefit cost ratio (BCR)

Comparison between the present worth of costs and present worth of benefits. Absolute value of the benefit cost ratio will change based on the interest rate chosen, because

$$BCR = \frac{\sum_{t=o}^{T} \frac{B_t}{(1+r)^t}}{\sum_{t=o}^{T} \frac{C_t}{(1+r)^t}}$$

Where;

B_t = Net return in year t, C_t = cost in year t,

r = Discount rate

t = number of years, i.e., 0, 1, 2…t

Internal rate of return (IRR)

It is the rate of return, which equates the discounted benefits with the discounted costs. It represents the marginal rate of return of mango plantations. IRR is arrived through the interpolation technique by using different discount rates, so as to see that the net present worth is equated to zero. The formula is:

$$IRR = LDR + \text{Difference between two discount rate} \left(\frac{\text{NPV at lower discount rate}}{\text{Absolute difference between the NPV at two Discount rate}} \right)$$

The IRR should be more than the discount rate, being considered for promising economic feasibility and financial soundness.

RESULTS AND DISCUSSION

Cost and returns of mango cultivation

Being a perennial crop, the mango orchard will bear the fruits from 6th year on wards. Hence cost incurred up to 5th years is accumulated as establishment cost. The establishment cost included all the costs incurred from the initial establishment i.e., seed material and planting, fencing, gap filling up to the stage of bearing, i.e., 5th and 6th year. The total establishment cost included that of initial establishment, plus plant protection, fertilizer and manures, human labour, tillage, watch and ward, land tax up to the stage of bearing and repair and up of farm implements [5]. The establishment cost for five years was accordingly estimated at the prevailing prices of inputs during the period of the study.

Cost of establishment of mango orchard

The cost of establishment of mango in Krishnagiri district is presented in (Table 1). Total establishment cost of mango orchard per acre for five years was found to be Rs. 329937.5 and the net establishment cost of orchard per hectare was arrived Rs. 290937.5 after deducting the income from inter crop at Rs. 39000. In view that seen from the (Table 1) that rental value of land accounted the sum share of 39.18 per cent followed that human labour accounted 14.13 per cent and bullock labour and fertilizer and manures account for 14.94 per cent these are the maximum share in the establishment costs [6-7].

Table 1 Establishment cost of mango orchard per hectare (in Rs)

Establishment category	I Year	II Year	III Year	IV Year	V Year	Total	Percent
Initial Establishment							
Land Preparation	3000	0	0	0	0	3000	0.91
Digging and filling pits	4000	0	0	0	0	4000	1.21
Value of plant material	5500	0	0	0	0	5500	1.67
Planting and Staking	2000	0	0	0	0	2000	0.61
Gap filling expenditure	1375	0	0	0	0	1375	0.42
Fencing cost	1000	0	0	0	0	1000	0.30

Receipt and upkeep of farm implements	1625	0	0	0	0	1625	0.49
Sub total	18500					18500	5.67
Maintenance Cost							
Fertilizer and manures	8500	8500	9875	10325	12100	49300	14.94
Value of human labour wages	9000	9125	9500	9500	9500	46625	14.13
Value of bullock labour wages	7750	7750	7750	8500	8500	40250	12.20
Irrigation Charges	7000	7000	7000	6500	6000	33500	10.15
Watch and ward / security Guard	2500	2500	2500	2500	2500	12500	3.79
Sub total	34750	34875	36625	37325	38600	182175	55.21
Rental value + land tax	25852.5	25852.5	25852.5	25852.5	25852.5	129262.5	39.18
Total establishment charges (I+II+III)	79102.5	60727.5	62477.5	63177.5	64452.5	329937.5	100
Income from intercrop	7500	7500	8000	8000	8000	39000	
Net establishment cost (IV-V)	71602.5	53227.5	54477.5	55177.5	56452.5	290937.5	

Mango being a perennial crop, its life time extends over an economic life period of 35 years. Hence the annual share of establishment cost was worked out based on the assessment that the life time of mango as 50 years and it was Rs. 9426.78 per year in the Krishnagiri district [8].

Cost of production of mango

The results of study operation cost accounted 31.17 for average sample farms in the study area. It showed that cost of cultivation of mango crop cost decrease when age of tree increases (Table 2). The average yield of mango was 17.75 tonnes in 6 to 10 years crop and 24 tonnes in 11 to 20 years crop and 27.5 tonnes in above 21 years crop. The average net return for mango orchard is high in above 21 years crop Rs. 229492.5 and Rs. 242213.84 in 11 to 20 years' crop and Rs. 156030.84 in 6 to 10 year's crop [9]. The study found that cost of production of mango per tones was low (Rs. 3446.07) in above 20 years age group and 11-20 years age crop Rs. 3907.75 per tones orchard crops where as it was higher in 6-10 years around Rs. 5209.53 tones. The average yield of Saurashtra region was found 100.56 per quintal per ha and harvest price received by farmers was Rs. 2026 and the variations of price from Rs. 2015 per ha in marginal farmers and to Rs. 2026 per ha in large farmers. Gross income high in large farms Rs. 213379 and low in marginal farms Rs. 207281 in mango growers [10] (Ramani *et al* 2019).

Table 2 Cost of production of mango per hectare (in Rs)

Cost components	6-10 years	11-20 years	Above 21 years	Average	Percent
I. Annual Fixed Cost of Orchard Establishment					
Amortized annual share of establishment cost	27087.91	27087.91	27081.91	27087.91	28.92
Depreciation	2300	2300	2300	2300	2.56
Interest on fixed capital	31581.25	31581.25	31581.25	31581.25	33.71
Interest on working capital	3375	3516	3621	3504	3.74
Sub Total I	64344.16	64486.16	64592.16	64474.14	68.83
II. Operation Cost and Maintenance Cost					
Value of human labour wages	5500	6175	7075	6250	6.67
Value of bullock labour wages	3500	4125	4600	4075	4.35
Plant protection cost	6625	7000	8000	7208.33	7.70
Watch and ward expend	2000	2000	2000	2000	2.14
Irrigation charges	4500	4000	2500	3666.67	3.91
Farm yard manure	6000	6000	6000	6000	6.41
Sub Total II	28125	29300	30175	29200	31.17
III. Cost of cultivation (I+II)	92469.16	93786.16	94767.16	93674.16	100
Average mango yield (in tonnes)	17.75	24	27.5	23.08	
IV. Returns (in Rs)	248500	336000	385000	323166.7	
V. Net Returns (in Rs) (IV-III)	156030.84	242213.84	290232.84	229492.5	
VI. Cost of Production /tonnes	5209.53	3907.75	3446.07	4187.78	

Economic feasibility analysis of mango cultivation

The economic feasibility analysis for mango cultivation is presented in the (Table 3).

Table 3 Economic feasibility analysis of mango cultivation

Particulars	Krishnagiri district
NPV at 15% discount factor	492276.9
BCR at 15%	1.98
IRR	20.12

i) Net Present worth (NPW)

The net present worth was obtained by subtracting discounted cost stream from the discounted benefit stream at 15 per cent discount rate. The net present worth of the project was Rs. 492276.9 is indicated that positive NPV for the capital invested in the mango cultivation [11].

ii) Benefit-cost ratio (B:C ratio)

Benefit- cost ratio was used to measure returns per rupee of investment in mango cultivation. The benefit cost ratio was 1.98 indicating that an investment of Re. 1 would generate an income of Rs. 1.98 in mango cultivation. Hence the study conducted that mango cultivated in Krishnagiri is a viable one [12].

iii) Internal rate of return (IRR)

IRR measures the earning capacity of the investment. In the present study, the internal rate of return has been worked

out by interpolation method. According to National Bank for Agriculture and Rural Development, a project yielding an IRR of 15 per cent is considered to be economically viable. In the study, IRR for investment in mango cultivation was worked out to be 20.12 per cent [13-14]. Hence, the investment in mango cultivation in the study area was considered to be economically viable.

CONCLUSION

Mango is a perennial horticulture crop; hence cost of production of mango has been classified into direct and indirect costs. Direct cost included the operation and maintenance costs and indirect cost included the annual share of establishment cost, interest on fixed capital, interest on working capital and depreciation. The study found that average establishment cost of mango per ha is Rs. 290937.5 and operation and maintenance cost of orchard Rs. 29200 and the average yield of mango 17.75 tonnes in 6 to 10 years crop and 24 tonnes in 11 to 20 years crop and 27.5 tonnes in above 21 years crop. The average net return for mango orchard is Rs. 229492.5 in Krishnagiri district. The net present worth of the project was Rs. 492276.9 indicating higher returns for the capital investment in the mango cultivation. The estimated benefit cost ratio was 1.98 indicating that an investment in mango cultivation.

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